



Year: 2020

Physical and psychological health of medical students involved in the coronavirus disease 2019 response in Switzerland

Aebischer, Oriane ; Weilenmann, Sonja ; Gachoud, David ; Méan, Marie ; Spiller, Tobias Raphael

Abstract: AIMS Involvement of medical students in the coronavirus disease 2019 (COVID-19) response remains a matter of debate. The main argument against involvement relates to potential physical and psychological health risks. Hence, we aimed to compare the physical and psychological health of Swiss medical students involved in the COVID-19 response with their non-involved peers. Among those involved, we also compared frontline (working in a dedicated COVID-19 unit) and non-frontline students. In addition, we compared frontline medical students with frontline residents. **METHODS** We conducted a cross-sectional anonymous online study in Switzerland between 9 and 14 May 2020. Recruitment was through hospital, faculty and student societies mailing lists using a snowball technique. Exposure to COVID-19 patients, personal protective equipment (PPE) access, support and information by employer, as well as COVID-19 symptoms and diagnosis were collected with a self-reported questionnaire. Anxiety and depression were assessed using the Generalized Anxiety Disorder-7 (GAD-7) and the Patient Health Questionnaire-9 (PHQ-9). Burnout was assessed using two single items derived from the Maslach Burnout Inventory. **RESULTS** 550 medical students (66.7% women, median age 23 years) and 227 residents (70.5% women, median age 30 years) were included in the analyses. Approximately half of the medical students were involved in the COVID-19 response and 30% were frontline workers. Of the residents, 61.7% were frontline workers. Both medical students and residents reported high access to PPE, support and information by employer. Students involved in the COVID-19 response reported a similar proportion of COVID-19 symptoms or confirmed diagnoses ($p = 0.81$), but lower levels of anxiety ($p < 0.001$), depression ($p < 0.001$) and burnout ($p < 0.001$ for depersonalisation item), compared with their non-involved peers. Health outcomes of frontline students did not differ significantly compared with their non-frontline peers. Frontline students had lower levels of burnout than frontline residents ($p < 0.01$ for emotional exhaustion item); the remaining health outcomes did not significantly differ.

DOI: <https://doi.org/10.4414/smw.2020.20418>

Posted at the Zurich Open Repository and Archive, University of Zurich

ZORA URL: <https://doi.org/10.5167/uzh-198823>

Journal Article

Published Version



The following work is licensed under a Creative Commons: Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0) License.

Originally published at:

Aebischer, Oriane; Weilenmann, Sonja; Gachoud, David; Méan, Marie; Spiller, Tobias Raphael (2020). Physical and psychological health of medical students involved in the coronavirus disease 2019 response in Switzerland. *Swiss Medical Weekly*, 150:w20418.
DOI: <https://doi.org/10.4414/smw.2020.20418>

Physical and psychological health of medical students involved in the COVID-19 response in Switzerland

Aebischer Oriane^a, Weilenmann Sonja^b, Gachoud David^{ac}*, Méan Marie^{a*}, Spiller Tobias R.^{bd*}

^a Department of Internal Medicine, Lausanne University Hospital, Switzerland

^b Department of Consultation-Liaison Psychiatry and Psychosomatic Medicine, University Hospital Zurich, Switzerland

^c Educational Unit, School of Medicine, Faculty of Biology and Medicine, University of Lausanne, Switzerland

^d Faculty of Medicine, University of Zurich, Switzerland

Summary

AIMS: Involvement of medical students in the coronavirus disease 2019 (COVID-19) response remains a matter of debate. The main argument against involvement relates to potential physical and psychological health risks. Hence, we aimed to compare the physical and psychological health of Swiss medical students involved in the COVID-19 response with their non-involved peers. Among those involved, we also compared frontline (working in a dedicated COVID-19 unit) and non-frontline students. In addition, we compared frontline medical students with frontline residents.

METHODS: We conducted a cross-sectional anonymous online study in Switzerland between 9 and 14 May 2020. Recruitment was through hospital, faculty and student societies mailing lists using a snowball technique. Exposure to COVID-19 patients, personal protective equipment (PPE) access, support and information by employer, as well as COVID-19 symptoms and diagnosis were collected with a self-reported questionnaire. Anxiety and depression were assessed using the Generalized Anxiety Disorder-7 (GAD-7) and the Patient Health Questionnaire-9 (PHQ-9). Burnout was assessed using two single items derived from the Maslach Burnout Inventory.

RESULTS: 550 medical students (66.7% women, median age 23 years) and 227 residents (70.5% women, median age 30 years) were included in the analyses. Approximately half of the medical students were involved in the COVID-19 response and 30% were frontline workers. Of the residents, 61.7% were frontline workers. Both medical students and residents reported high access to PPE, support and information by employer. Students involved in the COVID-19 response reported a similar proportion of COVID-19 symptoms or confirmed diagnoses ($p = 0.81$), but lower levels of anxiety ($p < 0.001$), depression ($p < 0.001$) and burnout ($p < 0.001$ for depersonalisation item), compared with their non-involved peers. Health outcomes of frontline students did not differ significantly compared

with their non-frontline peers. Frontline students had lower levels of burnout than frontline residents ($p < 0.01$ for emotional exhaustion item); the remaining health outcomes did not significantly differ.

CONCLUSIONS: In a snowball sample of Swiss medical students involved in the response to the first wave of the COVID-19 pandemic, we observed similar physical and psychological health outcomes compared with their non-involved peers. The context in which medical students are involved is certainly critical. Access to PPE, perceived support by employers and perceived passage of information by employers could explain these findings. Further research is needed to better understand the role of these contextual factors on student physical and psychological health.

Keywords: medical student, resident, COVID-19, physical health, psychological health

Introduction

Involvement of medical students in the coronavirus disease 2019 (COVID-19) response still remains a matter of debate several months into the pandemic. Across and within countries, approaches to student involvement during the first wave have differed and ranged from early graduation to suspension of clinical rotations [1]. In Italy, a number of medical schools did not let their students work in the wards, despite a shortage of workforce [2]. In contrast, a Danish medical school reported having two thirds of its student population work as temporary residents [3]. In the UK, a call for more guidance was issued to better address the challenges of student safety [4]. The main argument against involvement relates to physical and psychological health risks for students [2, 5]. In contrast, the main arguments in favour of involvement relates to medical students' contribution to the healthcare system during the pandemic and the opportunity for a rich educational experience. Indeed, medical students are put to work with senior clinicians modelling the expected commitment toward the healthcare system and, foremost, their patients during

* Contributed equally to this work.

Correspondence:
Oriane Aebischer, MD, Department of Internal Medicine, Lausanne University Hospital (CHUV), 46 Bugnon St., CH-1011 Lausanne, oriane.aebischer[at]ehc.vd.ch

a crisis [6]. Of course, to counterbalance the above-mentioned risks for students, it is key that students' role, safety, supervision and support be addressed prior to involvement [7].

In Switzerland, medical students were called to participate in the COVID-19 response on a voluntary basis. Involvement could consist of working in ambulatory care or hospitals, in both COVID-19 and non-COVID-19 units. Involvement in the COVID-19 response could also consist of tasks within the healthcare system, but without direct patient contact (e.g., phone calls).

To our knowledge, few studies have assessed the physical and psychological health of medical students during the SARS-CoV-2 pandemic. Liu and colleagues reported high levels of depression and anxiety in quarantined medical students in Hubei [8]. Similarly, about one quarter of a Sichuan health professional students' cohort reported psychological distress during the pandemic [5], and a similar proportion of undergraduate medical students in Changzhi reported anxiety [9]. However, these studies did not specifically explore how the involvement in the COVID-19 response affected the students' health.

We hypothesised that student involvement in the COVID-19 response could put students' health at risk, not only physically (increased exposure to SARS-CoV-2 with subsequent risk of developing COVID-19), but also psychologically. We chose to assess the symptoms of anxiety, depression and burnout symptoms based on previous research that demonstrated increased prevalence of such symptoms among healthcare workers during pandemics [10, 11]. Therefore, our main objective was to compare the physical and psychological health of Swiss medical students involved in the COVID-19 response with their non-involved peers. Our secondary objective was to compare the health of those working at the frontline with their non-frontline peers. Our third objective was to compare frontline medical students with frontline residents, since the latter could be considered as a reference group for exposed healthcare workers.

Materials and methods

In this cross-sectional anonymous online study evaluating healthcare workers' health during the SARS-CoV-2 pandemic, inclusion criteria were studying medicine (year 1 to 6) in one of the seven Swiss faculties (Bern, Basel, Zürich University, Zürich ETH, Fribourg, Lausanne, Geneva) or working as a resident (postgraduate clinical experience ≤ 6 years and age ≤ 35 years) in any postgraduate training facility in Switzerland. As in previous studies [12–14], recruitment was through hospital, faculty and student societies mailing lists across Switzerland, using a snowball technique. However, we did not access or collect individual email addresses for recruiting purposes. The questionnaire was accessible through an internet link and was hosted on a server system of the University Hospital Zurich designed for (clinical) online studies with human participants, which has been also used in previous research.

After completion of the survey, participants had the opportunity to register for a newsletter to stay informed about the results of our studies. In line with federal regulations, the information was kept separate from the survey data and the

system was designed to exclude any possibility to match the email addresses with the survey data.

We categorised medical students as involved or not involved in the COVID-19 crisis. As mentioned previously, involvement could consist in working in ambulatory care or hospitals, in both COVID-19 and non-COVID-19 units. Involvement could also consist of working within the healthcare system without direct patient contact. Participants involved in the COVID-19 response were further divided in either frontline or non-frontline workers. We defined medical students working in COVID-19 units dedicated to diagnosis and treatment of patients with suspected or confirmed COVID-19 as "frontline".

During the first wave of infections, the Swiss federal council declared a nationwide public health emergency, decreeing, among other measures, that only urgent medical procedures should be conducted. Thus, the whole Swiss healthcare system was temporally transformed. Given this profound transformation, we assumed that all residents were involved in the healthcare response to the COVID-19 crisis, even if they continued to care for non-COVID patients. We further categorised the involvement of residents as frontline or non-frontline workers, based on the definition above.

The study was performed 2 weeks after the end of the 6-week lockdown in Switzerland, when the pandemic curve had already flattened (9 to 14 May 2020). We collected demographic data (age, sex, year of undergraduate study, years of postgraduate clinical experience), work characteristics (involvement in the COVID-response; work in clinical units designated to diagnosis and treatment of COVID-19 patients; perceived access to personal protective equipment [PPE], support and information offered by employer, sleep duration and medical errors), exposure to COVID-19 patients, COVID-19 symptoms or diagnosis, and questionnaires assessing psychological health. The questionnaire included closed questions with either a choice of proposed answers or a fixed scale (e.g. working hours or sleep duration). The full questionnaire is available in appendix 1. The questionnaire was provided in French, German and Italian. The language spoken by the students and residents was extrapolated from the language chosen to answer the questionnaire.

Outcomes were: (a) COVID-19 symptoms or confirmed disease and (b) anxiety, depression and burnout symptom level. As previously performed during the SARS-CoV-2 pandemic [12, 15], anxiety and depression were assessed using validated questionnaires: Generalized Anxiety Disorder-7 (GAD-7) [16] and Patient Health Questionnaire-9 (PHQ-9) [17]. The time period of reference for all questions was the past seven days [18]. Each questionnaire item was rated on a 4-point Likert scale (0 = not at all to 3 = nearly every day). An overall score was obtained by summing individual item ratings. Burnout was assessed using two single items derived from the Maslach Burnout Inventory (MBI) [19], assessed on a 7-point Likert scale (0 = never to 6 = daily). The first item was the burnout emotional exhaustion question: "I feel burned out from my work"; the second item was the burnout depersonalisation question "I do not really care what happens to some patients." Perceived access to PPE and perceived support and infor-

mation offered by employer were collected using a quantitative scale, seven being the best answer.

In terms of data analysis, results are expressed as number of participants (percentage) for categorical data, as median (interquartile range, IQR) for continuous variables. Between-group comparisons were performed using the chi-square test for categorical variables and either the Kruskal-Wallis test (e.g., age; average number of sleep hours) or Mann-Whitney U-tests (e.g., psychological health scores) for continuous variables. All analyses were conducted using the R statistical environment (Version 3.5.3) and JASP (Version 0.12).

No authorisation from the ethics committee was required, as the study did not fall within the scope of the Human Research Act (decision of the ethics committee of the canton Zurich; BASEC-Nr. Req-2020-00471).

Results

Overall, 788 medical students and residents completed the survey. Of these, 11 did not fulfil the inclusion criteria and were therefore excluded, resulting in a final sample size of 777 participants. The response rate could not be calculated because of the snowball recruitment technique. The characteristics of participants are summarised in table 1.

Briefly, our sample included 550 medical students (70.1%) and 227 residents (29.9%). Of the students, 60.2% were French speakers, 33.5% German speakers and 6.4% Italian speakers. Two thirds of medical students were women, and the students' median age was 23 years. About half of the students were involved in the COVID-19 response and 30% of all the students were considered frontline health-care workers. Involved students were older than their non-

involved peers (median age 24 years, IQR 22–25 vs 22 years, IQR 20–23; $p < 0.001$).

The majority of residents (70.5%) were women, and the residents' median age was 30 years. Of the residents, 47.6% were French speakers, 45.8% German speakers and 6.6% Italian speakers. Two thirds of the residents worked frontline.

Both medical students and residents reported a high access to PPE, support and information by employer.

Students involved in the COVID-19 response reported a similar proportion of COVID-19 symptoms or disease (16.9%) compared with their non-involved peers (16.1%) ($p = 0.81$), and lower symptoms of anxiety (median GAD-7 score 4 vs 6, $p < 0.001$), depression (median PHQ-9 score 4 vs 7, $p < 0.001$) and burnout (median 1 vs 3 on de-personalisation item, $p < 0.001$). Health outcomes of frontline students did not differ significantly compared with their non-frontline peers. Frontline students had lower levels of the emotional exhaustion burnout item than frontline residents (median 1 vs 2, $p < 0.01$); the remaining health outcomes did not significantly differ (table 2).

Discussion

To our knowledge, this is the first study comparing the health of medical students involved in the COVID-19 response with their non-involved peers. Our reassuring results regarding health outcomes of involved and frontline students must be interpreted in the light of our national context. First, data were collected when the Swiss pandemic curve had already flattened (9 to 14 May 2020), 2 weeks after the end of the lockdown. However, a previous

Table 1: Demographics, work characteristics, and COVID-19 exposure of medical and residents (n = 777).

	Students involved* in COVID-19 (n = 296)	Students not involved in COVID-19 (n = 254)	Residents (all) (n = 227)	Across categories (overall test) p-value	Between students p-value
Demographics					
Age, median (IQR), y	24 (22–25)	22 (20–23)	30 (28–32)	<0.001¶	<0.001
Women, n (%)	194 (65.5)	173 (68.1)	160 (70.5)	0.484	0.524
1st–3rd year medical students, n (%)	83 (28.0)	190 (74.8)	NA	NA	<0.001
4th year medical students, n (%)	64 (21.6)	32 (12.6)	NA	NA	<0.001
5th year medical students, n (%)	56 (18.9)	17 (6.7)	NA	NA	<0.001
6th year medical students, n (%)	93 (31.4)	15 (5.9)	NA	NA	<0.001
Work characteristics					
Average number of sleep hours in the previous 7 days†, median (IQR)	7 (7–8)	7.5 (7–8)	7 (6–7.5)	<0.001¶	0.241
Reported at least one medical error, n (%)	18 (6.1)	NA	42 (18.5)	NA	NA
Having access to personal protective equipment, median (IQR)	6 (5–7)	NA	6 (4–6)	NA	NA
Perceived support by employer‡, median (IQR)	6 (5–7)	NA	6 (4–7)	NA	NA
Perceived passage of information by employer§, median (IQR)	6 (4–6)	NA	6 (4–7)	NA	NA
COVID-19 exposure					
Exposed to suspected or confirmed COVID-19 patients at work, n (%)	182 (61.5)	17 (6.7)	176 (77.5)	<0.001	<0.001
Worked in a clinical unit designated to diagnosis and treatment of patients with suspected or confirmed COVID-19, n (%)	160 (54.0)	NA	140 (61.7)	NA	NA

IQR = interquartile range; NA = not available. Results are expressed as number of participants (percentage) for categorical data, as median (interquartile range) for continuous variables. Between-group comparisons using chi-square test for categorical variables and Kruskal-Wallis test (¶) for continuous variables. * Involved in the COVID-19 response: Were involved in the COVID-19 related response (e.g., as a temporary help in a hospital/clinic), in either COVID-19 or non-COVID-19 units † 16 missing answers (n = 761), Students involved in COVID response: n = 289, Students not involved in COVID response: n = 250, Residents: n = 222 ‡ 44 missing answers (n = 479), students involved in COVID-19 response: n = 259, residents: n = 220 § 46 missing answers (n = 477), students involved in COVID-19 response: n = 250, residents: n = 227

Swiss study comparing mental health (depression, anxiety and burnout) of Swiss healthcare workers at the height of the pandemic (28 March to 4 April 2020) and after its flattening (9 to 14 May 2020) showed no substantial difference. Therefore, an earlier data collection probably would not have changed the conclusions of this study. Second, our healthcare system was impacted differently across the country, but overall it resisted rather well the first pandemic wave. In particular, it was able to anticipate resources based on the experience reported by our Italian neighbour. In addition, timely public health measures contributed to avoiding an uncontrolled mismatch between needs and resources. In these circumstances, our participants rated the support provided by their employers as high.

In terms of physical health, we did not find any difference between involved or frontline students and their non-involved or non-frontline peers. To our knowledge, no previous study has compared physical health in these specific subgroups. Previous studies have focused on physical health of healthcare workers. A recent Danish study [20] conducted in a large size-cohort of 29,295 healthcare workers showed a higher seroprevalence in frontline healthcare workers (7.2%) as compared with non-frontline personnel (4.4%; $p > 0.001$). However, the prevalence of Danish healthcare workers with antibodies against SARS-CoV-2 was low (4%) and only slightly higher than in blood donors (3%). It is also worth noticing that the SARS-CoV-2 seroprevalence among healthcare workers varies between countries and is much lower in Germany [21] (1.6%) or Denmark [20] (4%) than in Spain [22] (11%) or China [23] (18%). To date, the SARS-CoV-2 seroprevalence in healthcare workers in Switzerland is unknown. Preliminary results from the COVID-19 MISS study [24] conducted in the Lausanne University Hospital reported a seroprevalence of 10% in a sample of 1865 hospital employees. An ongoing national research programme, Corona Immunitas [25], will determine the level of immunity of the Swiss population and specific subgroups such as healthcare workers.

Therefore, to ensure the safety of medical students involved in the COVID-19 response, it remains critical to ensure not only access to PPE [26], but also adequate training on protective measures. Students' involvement in the frontline COVID-19 workforce should be voluntary and

personal risk factors must be checked beforehand [7]. In terms of mental health, lower levels of adverse symptoms in involved students could be explained by a selection bias, given that students with mental health problems were possibly less likely to volunteer. In addition, preserved access to PPE, combined with adequate support and information by employers, likely decreased anxiety among those involved in the COVID-19 response. Furthermore, a higher sense of coherence due to meaningful involvement in the pandemic response could be a key protective factor. The higher levels of adverse mental health symptoms in non-involved students could also be explained by difficulties in adapting to online teaching, concerns about examination performance and increased isolation [9].

Our results show no significant differences between frontline students and their non-frontline peers in terms of psychological health. This concurs with an Italian study reporting no significant difference between frontline and non-frontline healthcare workers in terms of depression and anxiety [12]. In contrast, Lai and colleagues reported higher levels of depression and anxiety in Chinese frontline healthcare workers compared with second-line workers [15].

Our results show no significant differences between frontline students and frontline residents in terms of depression and anxiety. However, we noted lower levels of burnout on the emotional exhaustion burnout item. Students' employment for a limited duration could perhaps explain this difference.

Our study has several limitations. First, a response rate could not be calculated owing to the snowball recruitment technique. Second, the use of a snowball technique may have led to selection of participants, based on the assumptions that students and residents would transmit the survey to friends and colleagues who may share similar characteristics or risk factors. However, a previous article reported a lack of selection bias in snowball sampled studies [27]. Third, in relation to the recruitment technique, the language distribution in our sample did not reflect the language distribution in the population in Switzerland. Fourth, we did not adjust for factors impacting psychological health measures, in particular gender and age. However, gender distribution did not significantly differ between groups. Moreover, also outside of our study population stu-

Table 2: Suspected or confirmed COVID-19, symptom levels of anxiety, depression and burnout in medical students and residents.

	All students			Students involved			Frontline		
	Involved* (n = 296)	Not involved (n = 254)	p-value	Frontline† (n = 160)	Not frontline‡ (n = 136)	p-value	Students§ (n = 160)	Residents¶ (n = 140)	p-value
COVID-19 suspected or confirmed, n (%)	50 (16.9)	41 (16.1)	0.81	27 (16.9)	23 (16.9)	>0.99	27 (16.9)	27 (19.3)	0.58
Anxiety GAD-7 total score, median (IQR)	4 (2–7)	6 (3–11)	<0.001	4 (2–7.3)	4 (2–7)	0.80	4 (2–7.3)	5 (2–8)	0.23
Depression PHQ-9 total score, median (IQR)	4 (2–8)	7 (4–12)	<0.001	4 (2–7)	5 (2–8)	0.33	4 (2–7)	4 (2–8)	0.25
Burnout, median (IQR)									
– Emotional exhaustion	1 (0–3)	2 (0–4)	0.002	1 (0–3)	1.5 (0–3)	0.79	1 (0–3)	2 (1–4)	<0.01
– Depersonalisation	1 (0–3)	3 (1–4)	<0.001	1.5 (0–4)	1 (0–3)	0.36	1.5 (0–4)	2 (0–4)	0.36

Definitions: * Involved in the COVID-19 response: Were involved in the COVID-19 related response (e.g. as a temporary help in a hospital/clinic), in either COVID-19 or non-COVID-19 units † Frontline: Worked in designated COVID-19 units (clinical unit designated to diagnosis and treatment of patients with suspected or confirmed COVID-19) ‡ Not frontline: involved in the COVID-19 response, worked in non-COVID-19 units § Students: Students involved in the COVID-19 response and working as frontline workers (undergraduate years 1 to 6) ¶ Residents: postgraduate with ≤6 years of clinical experience and age inferior or equal to 35 || COVID-19 suspected or confirmed: had symptoms of SARS-CoV2 (e.g. fever, cough) or were tested positive for SARS-CoV2 Results are expressed as number of participants (percentage) for categorical data, as median (interquartile range) for continuous variables. Between-group comparisons using chi-square test for categorical variables and Mann-Whitney U-tests for continuous variables.

dents are mostly younger than residents. Thus, the generalisability of our results is not impacted substantially by not adjusting them for age of the participants. In addition, we chose to focus on group comparison in real life settings (e.g. expected age difference between residents and students). Fifth, the adaptation of all questionnaires to cover symptom experience over the last 7 days has not been validated and limits comparability to studies undertaken with the original validated versions of the questionnaires (covering 2 weeks in the case of the GAD-7 and PHQ-9) and a full year in the case of the brief measurement tool for physician burnout. However, the rationale of the restriction to the past 7 days lies in the capacity to measure symptoms during a highly dynamic time of crisis. A last limitation consists of health being assessed using self-reported questionnaires. This might lead to an overestimation of symptoms [17].

In conclusion, in a snowball sample of Swiss medical students involved in the response to the first wave of the COVID-19 pandemic, we observed similar physical and psychological health outcomes compared with their non-involved peers. The context in which medical students are involved is certainly critical. Access to PPE, perceived support by employers and perceived passage of information from employers could explain these findings. Further research is needed to better understand the role of these contextual factors on student physical and psychological health. International initiatives, such as the [Collaborative Outcomes study on Health and Functioning during Infection Times](#), will explore differences across contexts and changes over time. Finally, qualitative approaches allow interviews of individual students and, thereby, access their lived experience.

Financial disclosure

Tobias R. Spiller was supported by a Forschungskredit of the University of Zurich, grant no. [FK-19-048].

Potential competing interests

The authors declare no conflict of interest.

References

- Klasen JM, Vithyapathy A, Zante B, Burn S. "The storm has arrived": the impact of SARS-CoV-2 on medical students. *Perspect Med Educ*. 2020;9(3):181–5. doi: <http://dx.doi.org/10.1007/s40037-020-00592-2>. PubMed.
- Riva M, Paladino M, Belingheri M. Ethical consideration on the role of medical students in During the COVID-19 Pandemic. Answer to Miller DG, Pierson L, Doernberg S. The Role of Medical Students During the COVID-19 Pandemic. *Ann Intern Med*. 2020:M20-1281. doi: <http://dx.doi.org/10.7326/M20-1281>.
- Rasmussen S, Sperling P, Poulsen MS, Emmersen J, Andersen S. Medical students for health-care staff shortages during the COVID-19 pandemic. *Lancet*. 2020;395(10234):e79–80. doi: [http://dx.doi.org/10.1016/S0140-6736\(20\)30923-5](http://dx.doi.org/10.1016/S0140-6736(20)30923-5). PubMed.
- Baker DM, Bhatia S, Brown S, Cambridge W, Kamarajah SK, McLean KA, et al.; Representatives of the STARSurg Collaborative, EuroSurg Collaborative, and TASMAN Collaborative. Medical student involvement in the COVID-19 response. *Lancet*. 2020;395(10232):1254. doi: [http://dx.doi.org/10.1016/S0140-6736\(20\)30795-9](http://dx.doi.org/10.1016/S0140-6736(20)30795-9). PubMed.
- Li Y, Wang Y, Jiang J, Valdimarsdóttir UA, Fall K, Fang F, et al. Psychological distress among health professional students during the COVID-19 outbreak. *Psychol Med*. 2020;1-3:1–3. doi: <http://dx.doi.org/10.1017/S0033291720001555>. PubMed.
- Halbert JA, Jones A, Ramsey LP. Clinical placements for medical students in the time of COVID-19. *Med J Aust*. 2020;213(2):69–69.e1. doi: <http://dx.doi.org/10.5694/mja2.50686>. PubMed.
- Medical Deans Australia and New Zealand. Principles to support medical students' safe and useful roles in the COVID-19 health workforce 2020 [updated 2020 Mar 20]. Available from: http://medicaldeans.org.au/md/2020Available%20from%20%2F03%2F2020-March-20_principles-for-medical-student-roles-in-COVID-19-health-workforce.pdf.
- Liu J, Zhu Q, Fan W, Makamure J, Zheng C, Wang J. Online Mental Health Survey in a Medical College in China During the COVID-19 Outbreak. *Front Psychiatry*. 2020;11:459. doi: <http://dx.doi.org/10.3389/fpsy.2020.00459>. PubMed.
- Cao W, Fang Z, Hou G, Han M, Xu X, Dong J, et al. The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry Res*. 2020;287:112934. doi: <http://dx.doi.org/10.1016/j.psychres.2020.112934>. PubMed.
- Chong MY, Wang WC, Hsieh WC, Lee CY, Chiu NM, Yeh WC, et al. Psychological impact of severe acute respiratory syndrome on health workers in a tertiary hospital. *Br J Psychiatry*. 2004;185(2):127–33. doi: <http://dx.doi.org/10.1192/bjp.185.2.127>. PubMed.
- Marjanovic Z, Greenglass ER, Coffey S. The relevance of psychosocial variables and working conditions in predicting nurses' coping strategies during the SARS crisis: an online questionnaire survey. *Int J Nurs Stud*. 2007;44(6):991–8. doi: <http://dx.doi.org/10.1016/j.ijnurstu.2006.02.012>. PubMed.
- Rossi R, Succi V, Pacitti F, Di Lorenzo G, Di Marco A, Siracusano A, et al. Mental Health Outcomes Among Frontline and Second-Line Health Care Workers During the Coronavirus Disease 2019 (COVID-19) Pandemic in Italy. *JAMA Netw Open*. 2020;3(5):e2010185. doi: <http://dx.doi.org/10.1001/jamanetworkopen.2020.10185>. PubMed.
- Chi X, Becker B, Yu Q, Willeit P, Jiao C, Huang L, et al. Prevalence and Psychosocial Correlates of Mental Health Outcomes Among Chinese College Students During the Coronavirus Disease (COVID-19) Pandemic. *Front Psychiatry*. 2020;11:803. doi: <http://dx.doi.org/10.3389/fpsy.2020.00803>. PubMed.
- Aiyer A, Surani S, Ratnani I, Surani S. Mental Health Impact of COVID-19 on Healthcare Workers in the USA: A Cross-Sectional Web-Based Survey. *J Depress Anxiety*. 2020. doi: <http://dx.doi.org/10.35248/2167-1044.20.9.373>.
- Lai J, Ma S, Wang Y, Cai Z, Hu J, Wei N, et al. Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019. *JAMA Netw Open*. 2020;3(3):e203976. doi: <http://dx.doi.org/10.1001/jamanetworkopen.2020.3976>. PubMed.
- Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med*. 2006;166(10):1092–7. doi: <http://dx.doi.org/10.1001/archinte.166.10.1092>. PubMed.
- Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med*. 2001;16(9):606–13. doi: <http://dx.doi.org/10.1046/j.1525-1497.2001.016009606.x>. PubMed.
- Spiller TR, Méan M, Ernst J, Szapinar O, Gehrke S, Paolercio F, et al. Development of health care workers' mental health during the SARS-CoV-2 pandemic in Switzerland: two cross-sectional studies. *Psychol Med*. 2020;1-4:1–4. doi: <http://dx.doi.org/10.1017/S0033291720003128>. PubMed.
- West CP, Dyrbye LN, Sloan JA, Shanafelt TD. Single item measures of emotional exhaustion and depersonalization are useful for assessing burnout in medical professionals. *J Gen Intern Med*. 2009;24(12):1318–21. doi: <http://dx.doi.org/10.1007/s11606-009-1129-z>. PubMed.
- Iversen K, Bundgaard H, Hasselbalch RB, Kristensen JH, Nielsen PB, Pries-Heje M, et al. Risk of COVID-19 in health-care workers in Denmark: an observational cohort study. *Lancet Infect Dis*. 2020:S1473-3099(20)30589-2. doi: [http://dx.doi.org/10.1016/S1473-3099\(20\)30589-2](http://dx.doi.org/10.1016/S1473-3099(20)30589-2). PubMed.
- Korth J, Wilde B, Dolf J, Anastasiou OE, Krawczyk A, Jahn M, et al. SARS-CoV-2-specific antibody detection in healthcare workers in Germany with direct contact to COVID-19 patients. *J Clin Virol*. 2020;128:104437. doi: <http://dx.doi.org/10.1016/j.jcv.2020.104437>. PubMed.
- Garcia-Basteiro AL, Moncunill G, Tortajada M, Vidal M, Guinovart C, Jiménez A, et al. Seroprevalence of antibodies against SARS-CoV-2 among health care workers in a large Spanish reference hospital. *Nat Commun*. 2020;11(1):3500. doi: <http://dx.doi.org/10.1038/s41467-020-17318-x>. PubMed.
- Chen Y, Tong X, Wang J, Huang W, Yin S, Huang R, et al. High SARS-CoV-2 antibody prevalence among healthcare workers exposed to COVID-19 patients. *J Infect*. 2020;81(3):420–6. doi: <http://dx.doi.org/10.1016/j.jinf.2020.05.067>. PubMed.
- <https://www.chuv.ch/fr/chuv-home/liste-des-actualites/detail/news/47388-covid-19-10-de-seroprevalence-chez-les-collaborateurs-du-chuv/2020> [2020 Aug 28].
- <https://www.corona-immunitas.ch/program> 2020 [2020 Aug 28].
- Chou R, Dana T, Buckley DI, Selph S, Fu R, Totten AM. Epidemiology of and Risk Factors for Coronavirus Infection in Health Care Workers:

- A Living Rapid Review. *Ann Intern Med.* 2020;173(2):120–36. doi: <http://dx.doi.org/10.7326/M20-1632>. [PubMed](#).
- 27 Lopes CS, Rodrigues LC, Sichieri R. The lack of selection bias in a snowball sampled case-control study on drug abuse. *Int J Epidemiol.* 1996;25(6):1267–70. doi: <http://dx.doi.org/10.1093/ije/25.6.1267>. [PubMed](#).

Appendix 1

Survey questions

The appendix is available as a separate file at <https://smw.ch/article/doi/smw.2020.20418>.